

PATENT SPECIFICATION

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(54) CINEMATOGRAPHIC APPARATUS

(71) We, BOLEX INTERNATIONAL S.A., of 18 Avenue des Alpes, CH 1450 Sainte-Croix, Switzerland, a Swiss Company, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to a cine camera. Commonly a cine camera has a zoom lens provided with focal length varying means driven by an electrical motor running at 3000 to 6000 R.P.M.

Film advance in a camera is conventionally performed step by step, the projection light beam being obturated periodically by a shutter to hide the advance movements of the film.

Since the focal length of a zoom lens and thus its magnification is varied continuously and cannot be observed during the obturation periods, the magnification of successively projected images appears to be varied in jerks each corresponding to an obturation period in which zooming took place. These jerks are more pronounced if the focal length is increasing.

An object of this invention is the provision of an improved film camera.

In accordance with the present invention, there is provided a cinecamera having a lens zooming facility and a synchronizing arrangement restricting operation of the zooming facility to those periods as below defined in which exposure of a film frame is taking place. Each of said "periods" is to be understood as being one in which light is continuously incident on the film.

The invention will now be described in more detail, by way of example, with reference to the accompanying graphical and partly diagrammatic drawings, in which:—

FIGURE 1 is a diagram illustrating conventional focal length variation using a zoom lens;

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FIGURE 2 is a diagram illustrating the manner of focal length variation obtained by the apparatus of Figure 3; and,

FIGURE 3 is a partly sectional view illustrating a focal length variation mechanism operating in synchronization with a step by step film-advance mechanism.

In Figure 1, continuous magnification g variation is expressed as a function of time t . This variation is illustrated by a straight line a on which there are two obturation periods b and c . During one of these obturation periods, the magnification value has increased an amount d , which results in an apparent jerk to the viewer.

In Figure 2, the magnification of the zoom lens is not increased during the obturation periods but is instead increased at a faster rate between such periods b and c .

In consequence, jerkiness is avoided, and if the focal length is being varied quickly during the exposure, the image appears somewhat blurred because the focal length is changed over a significant range between the beginning and the end of the exposure time. During projection, such slight blurring tends to hide imperfections in the use of the zooming facility caused by inexperienced enthusiastic amateurs varying the focal length too quickly, and is therefore not disadvantageous.

The sectional view of Figure 3 shows part of a camera in plan view and taken perpendicularly to the optical axis. A variofocal lens, not shown, is moved by a shaft 1, the rotation of which varies the focal length of the lens. This shaft carries two ratchet wheels 2, 3 mounted side by side and having oppositely directed teeth.

The two ratchet wheels 2 and 3 are capable of being respectively rotated in opposite directions by two pawls 4 and 5, articulated on a lever 6 provided with three arms and which is pivoted on a pin 7. The pawl 4 is biased towards the wheel 2 by a

tension spring 8, while the other pawl 5 is biased towards the wheel 3 by an elliptic spring 9.

The lever 6 performs oscillatory movements when driven by a lever 10. Opposite ends of the lever 10 are bifurcated at 12 and 15 and it rocks about a fulcrum 11. Its upper end 12 embraces a pin 13 fixed on one arm 14 of lever 6. The lower bifurcated end 15 embraces one of two eccentrics 16 and 17 mounted on a driving shaft 18 controlling a film advance mechanism (not shown). The driving shaft 18 rotates once for each advance of the film through one film frame.

Selective arrangement of the pawls 4 and 5 with the ratchet wheels 2 and 3 respectively, is controlled by a hand lever 19 pivoted at 20. This lever, which represents a manual control is provided with two pins 21 and 22, of which the pin 21 co-operates with the pawl 4 to disengage it from the ratchet wheel 2 when the hand lever 19 is in one position, while simultaneously the other pawl 5 is freed so that it can be biased towards the ratchet wheel 3 by the spring 9.

The lever 19 may also occupy two other positions when pivoted anti-clockwise from the position illustrated in Figure 3. At the first of these positions the pin 22 engages a plate 23 on the pawl 5, to push the pawl 5 out of engagement with the ratchet wheel 3 so that it cannot be driven by oscillating movements of the lever 6. Also at this position, the pin 21 allows pawl 4 to approach but not engage the ratchet wheel 2. Thus, in this intermediate position of the lever 6 the drive of the lever is not imparted to the shaft 1.

By pivoting the lever 19 further anti-clockwise, it reaches its last position where the pin 21 frees the disengaging pawl 4 for engagement with the teeth of the ratchet wheel 2. Thus, lever 19 is able to occupy three different positions, whereby the two extreme ones allow the shaft 1 to be driven respectively in one or other direction while in the intermediary position the shaft is not driven and determines the chosen focal length of the zoom lens. The lever 19 is, in fact, biased continuously towards its intermediate position by a spring system which is not shown.

In Figure 3 shaft 18 is occupying a position which corresponds to the end of the obturation phase by the shutter. During the subsequent frame exposure, the rotation of shaft 18 displaces the eccentric 16 from the right side to the left side of the rotation axis, thus pivoting the lever 10 clockwise. This pivots the lever 6 anti-clockwise and the pawl 5 shown selected by the lever 19 moves the ratchet wheel 3 one step. In similar manner, had the hand

lever 19 been in the opposite extreme position to that shown, the pawl 4 would have moved instead the other ratchet wheel 2 one step counter-clockwise for the half rotation of the shaft 18 occurring during the frame exposure period.

During the following half-rotation of shaft 18, which brings the eccentric 16 back to the position shown in Figure 3, the lever 6 pivots clockwise and whichever of the pawls 4 and 5 is selected by the hand lever 19 to drive the shaft 1, jumps over the tooth of its ratchet wheel without moving it. Thus, successive focal length modifications of the zoom lens always occur while the film is stationary so that jerkiness in operating the zoom lens, which is normally noticeable when the zoom lens focal length is varied during the obturation period of the film frame, is avoided.

The above-described apparatus has other advantages than just removing apparent jerkiness in zoom lens operation. It is, for example, simple and has a good mechanical efficiency. Also, since the forces necessary to drive an adjustment ring for altering the focal length of a zoom lens are obtained from the driving shaft 18, which is driven by the camera motor, batteries used to energise the motor are used for shorter continuous periods when there is a constant current demand on the batteries. Also, the provision of an entirely separate drive normally used in commercially-available cameras for driving the focal length adjustment ring of a zoom lens, is avoided. An additional incidental advantage is that the zoom lens adjustment motor in a conventional camera normally rotates at a high speed, so that a speed reducer must be provided. In the above-described apparatus a speed reducer is not needed, and this reduces the price of manufacture.

It is evident that other mechanisms may be provided to synchronize the zoom lens focal length variation periods so that they occur between the obturation periods when the film is stationary and being exposed in the film gate. For instance, it is possible to provide a drive mechanism which rotates at a constant rate and drive the zoom adjustment mechanism, such adjustment mechanism being periodically stopped by a brake which is applied intermittently during periods coinciding with the obturation periods. In such cases, the transmission of a motor drive to the adjustment mechanism can be by way of a friction coupling which slips or spins relatively freely when the brake is applied.

The purpose of the two eccentrics 16 and 17 which are selectively engageable with the lower bifurcated end 15 of the lever 6, is to permit two different zooming

rates. To achieve this the eccentrics are of the same size but have different eccentricities. In this way it can be arranged for a single rotation of the eccentrics to cause the pawls to turn the ratchet wheels through an angle corresponding to one or two teeth, depending on which of the eccentrics is rocking the lever 6.

10 WHAT WE CLAIM IS:—

1. A cine camera having a lens zooming facility and a synchronizing arrangement restricting operation of the zooming facility to those periods as hereinbefore defined in which exposure of a film frame is taking place.
2. A cine camera as claimed in Claim 1, having a film-advance drive mechanism which also drives the zooming facility by way of the synchronizing arrangement.
3. A cine camera as claimed in Claim 1 or Claim 2, in which the zooming facility is driven by an indexing drive provided by a ratchet wheel rotated in steps by a pawl which is reciprocated back and forth by a motor drive transmitted through the synchronizing arrangement.
4. A cine camera as claimed in Claim 3, in which the indexing drive includes two ratchet wheels having respectively oppositely-handed teeth and co-operating with respective selectively engageable pawls one of which is engageable to drive one ratchet wheel in one direction while the other pawl is engageable to drive the other ratchet wheel in the opposite direction, selection of the zooming direction being controlled by a displaceable element having three positions, two of which each correspond to the engagement of a respective one of the two pawls with its associated ratchet wheel, while at the third position of the element neither of the pawls is engaged with its associated ratchet wheel.
5. A cine camera as claimed in any one of the preceding claims, in which the synchronizing arrangement includes a shaft controlling with its rotation stepwise advance of a drive for advancing a film through a film gate, the shaft rotating an

eccentric which revolves to produce rocking motion of a first lever providing a reciprocating pawl drive for operating zooming facility.

6. A cine camera as claimed in Claim 5, in which the shaft has at least two eccentrics of different eccentricity, and the first lever is selectively connectable to be driven by either of the eccentrics.

7. A cine camera as claimed in either of Claims 5 and 6 when dependent on Claim 4, in which the first lever reciprocates a second lever on which the two pawls are pivoted, and resilient biasing means urge the two pawls respectively towards the teeth of their respective ratchet wheels.

8. A cine camera as claimed in Claim 7, in which the displaceable element comprises a hand lever pivoted for rotation about an axis parallel to the fulcrum axes of the two levers and the rotational axes of the ratchet wheels and shaft, the hand lever carrying parts which co-operate with the pawls to determine their selective engagement with the ratchet wheels in first and second positions of the hand lever, which parts hold respective pawls disengaged from their ratchet wheels in the third hand lever position which is intermediate the first and second positions and towards which the lever is resiliently biased.

9. A cine camera as claimed in Claim 1, arranged and adapted to operate substantially as described with respect to Figures 2 and 3 of the accompanying drawing.

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Reference has been directed in pursuance of section 9, subsection (1) of the Patents Act 1949, to patent No. 1,268,998.

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